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The Impact of Population Ageing on International Capital Flows

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November 2010

Abstract:

This paper is oriented to study the relationship between demographical factors and international capital flows. We analyse the impact of ageing on foreign direct investments (FDI) and foreign portfolio investments (FPI) on a bilateral level. Firstly we present a theoretical foundation of the relationship and then we test it by an empirical model. Theoretical foundations are based on the lifecycle hypothesis and overlapping generations model in a demographic context. The bilateral FDI and FPI are modelled by using fixed effects balanced panel data. The results suggest that the current and future age structure of the nation has significant effect on current international capital flows.

Keywords: International Capital Flows, Demography, Capital Mobility, FDI, Portfolio Investment

JEL Classifications: E2, F21, G15, J1

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1. Introduction

Past decades have shown clear trends of the population ageing in the OECD countries. This is the result of the combination of two main developments in these countries: a decrease in the fertility rate and an increase in life expectancy. The immigration flows do not compensate for this decrease in the labour endowments. As a result the OECD countries will face the problems of insufficient labour force and increasing costs of financing the retirement pensions. This is expected to have an important impact on the level of future returns on capital, prices of financial assets and international capital movements.

However, the demographic transition processes or age structure evolution have different timings across different regions in the world¹. Many non-OECD countries will face an important positive labour force growth while the OECD countries will be confronted with a negative labour force growth. This implies different age structure and dependency ratios across the globe².

Hence, to the extent that capital is internationally mobile, the important differences in current and future dependency ratios implied by these different ageing patterns are supposed to have a positive effect on the flows of capital from developed countries (relatively more aged countries) to emerging countries (relatively less aged countries).

So far the studies testing an impact of demographical factors on international capital flows focus on a very aggregate level (e.g. they use data on current account, capital outflows - defined by the net value of gross domestic savings minus domestic investments).

However, as noticed by Lane and Milesi-Ferretti (2000), among others, different types of capital flows have different properties with regard to features such as risk, liquidity, tradability, reversibility, expropriability and tax treatment. Only under perfect information and with no distortions, can we consider the capital structure as irrelevant (according to the Modigliani-Miller Theorem). Since

¹ Although all facing an increase in the share of the older people and a decline in the share of younger people.

² Appendixes 1 and 2 show the old age and young age dependency ratios forecasts for a selected list of countries. All ratios are presented as number of dependants per 100 persons of working age.

demographic factors can have different impacts on different types of international capital flows the aggregation of the capital flows can lead to overestimation of the coefficients.

In this paper we analyse the impact of ageing in different types of capital flows, namely on foreign direct investments (FDI) and foreign portfolio investments (FPI)³, on a bilateral level.

Firstly we present a theoretical foundation of the relationship and then we test it by empirical model. Theoretical foundations are based on the Lifecycle Hypothesis and Overlapping Generations (OLG) model in a demographic context. The bilateral FDI and FPI are modeled by using fixed effects balanced panel data.

The results suggest that the current and future age structure of the nation has significant effect on current international capital flows. Moreover, we found evidence that demographic factors have different impacts on FPI and FDI.

The structure of the rest of the paper is as follows. In section 2 we enlighten some stylised facts. In section 3, we give a very brief overview of the theoretical background and empirical works done in this field. In section 4, we build up an empirical model to test the linkages. In section 5, we describe the data and variables we use for econometric modelling. In section 6, we report the econometric results. In section 7 we conclude and point out several directions for future research.

2. Stylised facts

The world economy is currently confronted with two important trends, one concerns the recent evolution in international capital flows, and their role in the developing process of the emerging economies, and the other one concerns the current and future evolution in demographical patterns.

³ This includes equities and short-term and long-term debt securities.

On the investment side, capital flows to developing countries have increased in recent years, mostly taking the form of FDI. This phenomenon is illustrated in Figure 1 and Figure 2. Figure 1 shows that for the period of 1980 to 2008 the FDI net inflows to different developing countries has substantially increased. Figure 2 shows that the FDI net inflows as a percentage of GDP, for the same period and group of countries, also point up an upward trend.

Figure 1: FDI Net Inflows to developing countries (millions of current USD)

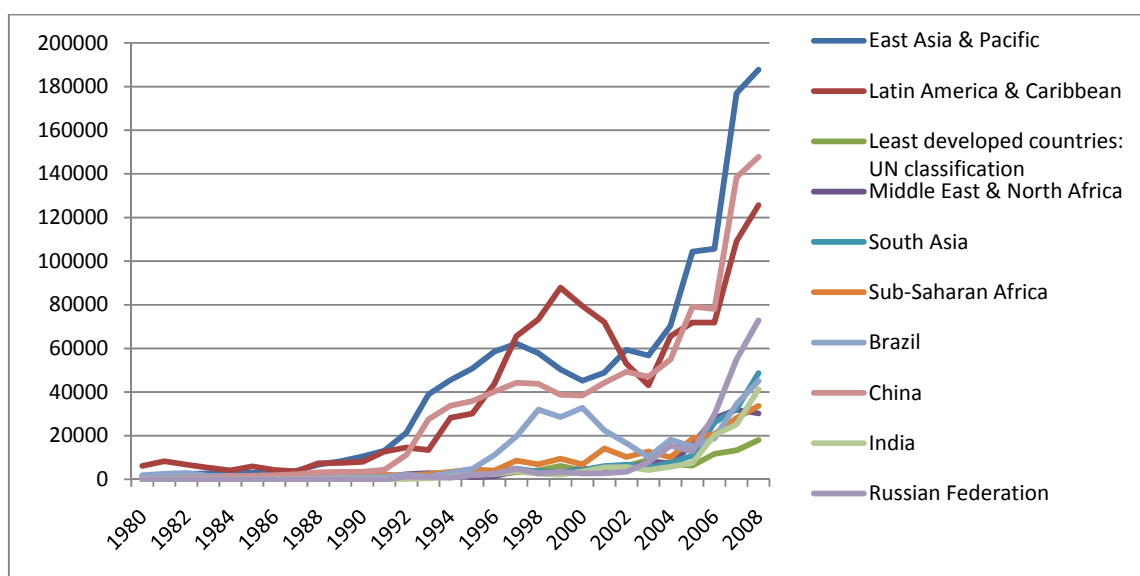
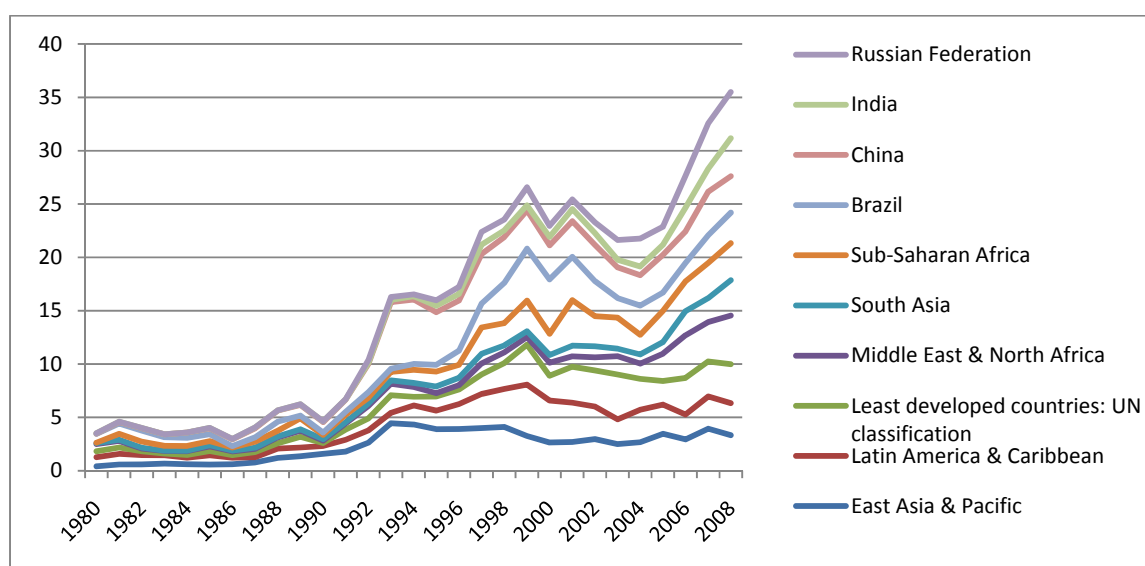


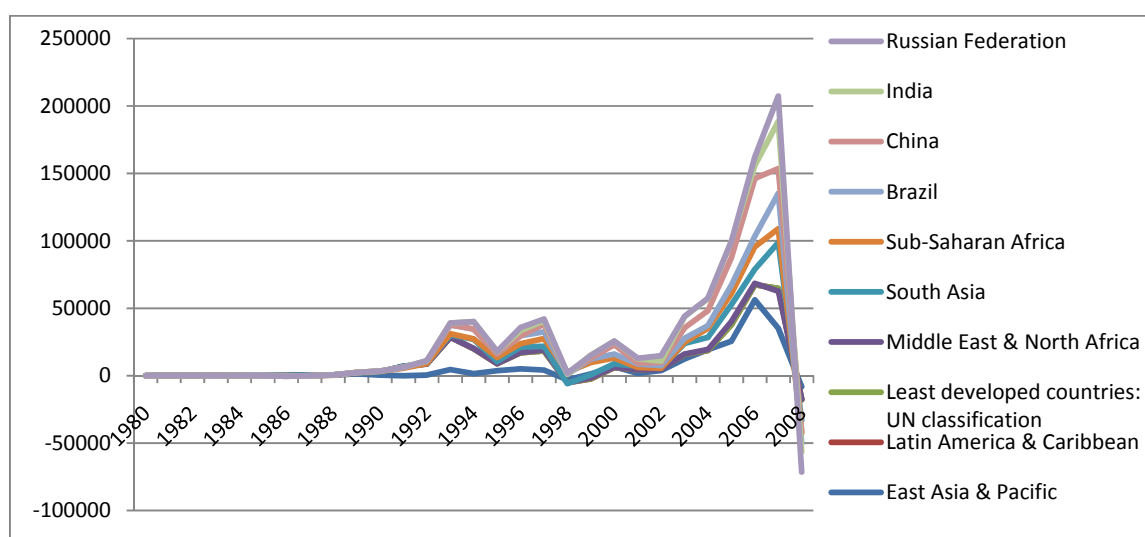
Figure 2: FDI Net Inflows (% of GDP) to developing countries



Figures 1 and 2 Source: authors' calculations from the data of the World Development Indicators

If we look now to the Foreign Portfolio Equity Investments to developing countries, a somewhat different pattern is perceptible. Figure 3 illustrates that outline also for the period of 1980 to 2008. We can see that the Portfolio Equity net inflows to developing countries remained relatively unchanged in the 80's, increased modestly in the 90's for most of the observed countries and record a sharp increase in the first half of the last decade to end up with a big crash in the most recent years due to the current financial crisis⁴.

Figure 3: Portfolio equity, net inflows to emerging countries (millions of current USD)



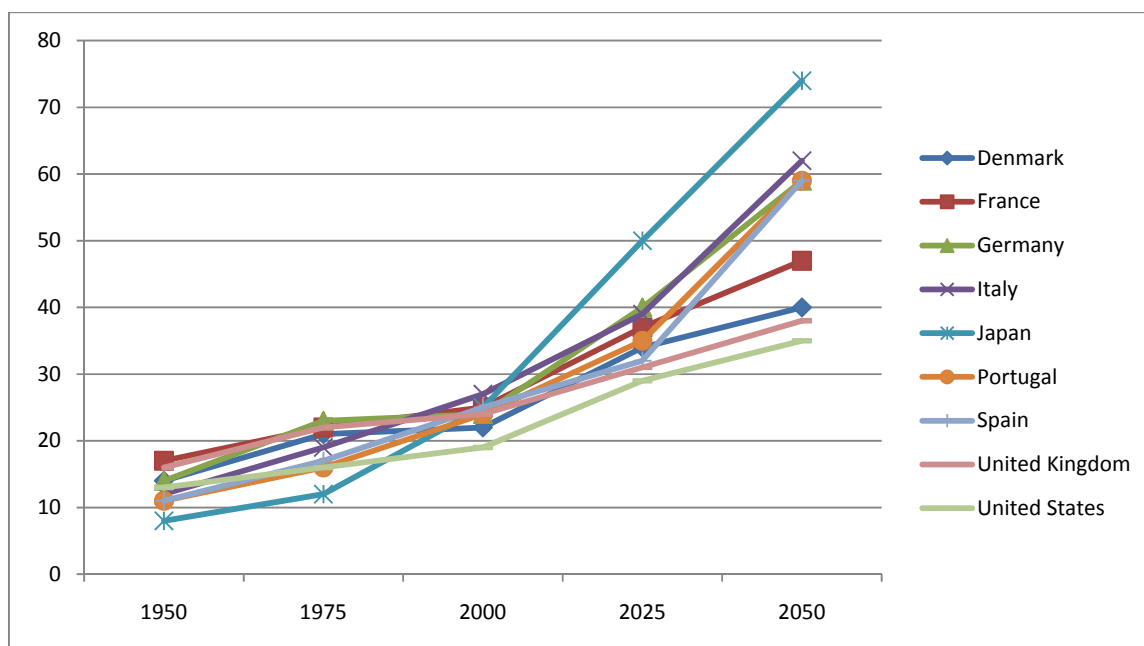
Source: authors' calculations from the data of the World Development Indicators

On the demographic side the trend concerns the difference in ageing patterns between industrialized and developing countries. Industrialized countries are ageing significantly faster than other countries mostly due to the ageing of the baby boom generation and the declining birth rates. In sharp contrast, the developing countries have a much younger population. This is illustrated in Figures 4 and 5 where we can observe the old age dependency ratios⁵ for a selection of industrialized and emerging countries from 1950 to 2050.

⁴ The turning point is 2006, when market rumors that the US economy was slowing down, lead to a big crash in the emerging economies stock markets.

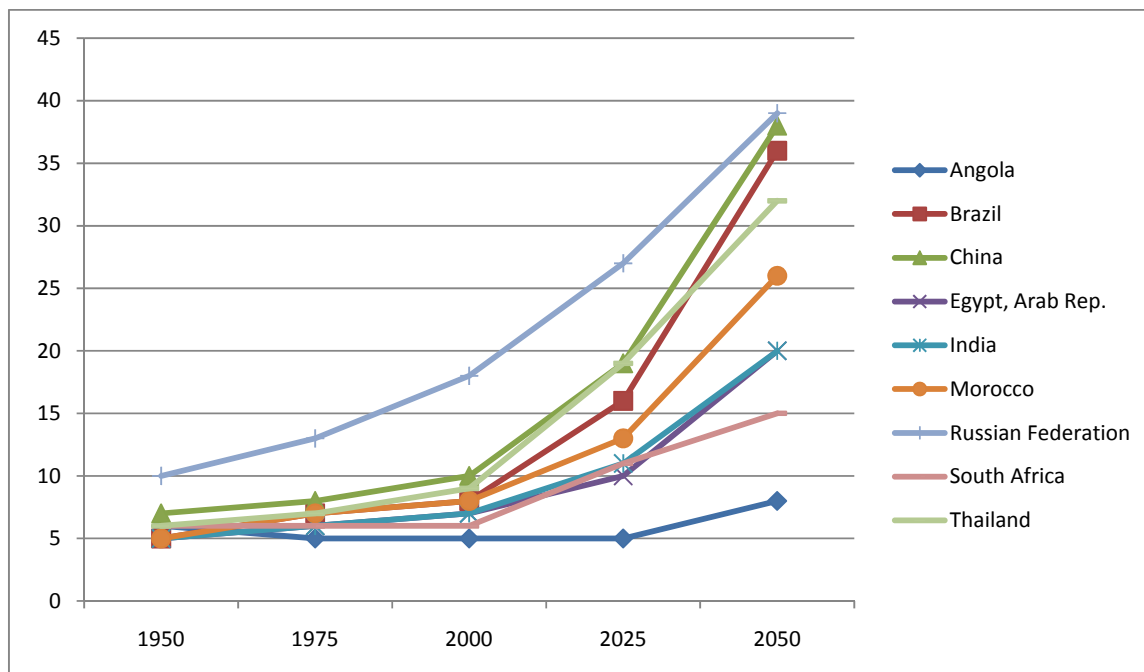
⁵ The ratios are presented as number of population aged 65+ per 100 persons of working age (15-65).

Figure 4: Old Age Dependency Ratios for a selection of developed countries



Source: authors' calculations from the data of the United Nations World Population Projects

Figure 5: Old Age Dependency Ratios for a selection of developing countries



Source: authors' calculations from the data of the United Nations World Population Projects

In the Figures we can observe that the old age dependency ratio forecast for 2050 is substantially higher for the developed countries than for the developing countries. As an example we can highlight the case of Japan, Germany Spain and Portugal, industrialized economies that are expected to have a three times higher old age dependency ratio than Angola, South Africa, Egypt or India. Even within the two groups of countries there are significant different age patterns between countries. In the group of developed countries, we can observe in Figure 4 that Japan is expected to have more that the double of old age dependents than the United States. Similarly, in the group of developing countries, we can see in Figure 5, that Russia is expected to have by 2050 a four times higher old dependency ratio than Angola.

The important differences in current and future dependency ratios implied by these different ageing patterns are supposed to have a positive effect on the flows of capital to emerging markets through three different channels. Firstly, the ageing of populations in industrial countries could lead to an increase in savings of working people in the short to medium term. Secondly, differences in demographics are likely to reinforce the differentials in the expected rates of return to capital between industrial and developing countries. Thirdly, the ageing of populations in industrial countries is leading to pressures for pension reform. These reforms, some of them already in course in most of the OECD countries, are likely to result in greater responsiveness on the part of pension funds to investment opportunities in developing countries. And even within developed countries we can expect capital flows from relatively more aged countries to relatively less aged countries, since the age patterns within OECD countries also record significant differences, as stressed out before.

3. Theoretical background and earlier empirical works

The first group of studies in this field relies on the **Life Cycle Theory** of consumption and savings by Modigliani, which makes use of the dependency hypothesis⁶ (Modigliani and Brumberg 1954 and Ando and Modigliani 1963).

⁶ Formulated by Coale and Hoover (1958).

The lifecycle hypothesis states that individuals tend to smooth their consumption over time. Individuals accumulate assets during their working years and consume these assets during their retirement years (Bommier and Lee 2000). According to the hypothesis, individuals tend to consume different kinds of assets at different moments in their lifetime. In the beginning of their active life, they tend to invest in housing and progressively in more risky assets. As they grow old and have fewer working years ahead of them, they tend to invest in less risky assets as they cannot rely anymore on an income in the next period of their life (the retirement period). In other words, in earlier periods of their working life, they are willing to bear more risk because they rely on their income. In the last period of life, people's income is smaller thus becoming more averse towards risky assets. Thus people seem to shift from preference for risky assets to preferences for less risky assets. This hypothesis is also occasionally called the **Lifecycle Risk Aversion Hypothesis**, which establishes the rationale for agents with constant risk aversion to substitute from equity to bonds as they age, assuming that most investors' labour income are poorly correlated with stock returns.

Several empirical studies confirm the relationship between savings and age predicted by the life cycle theory (Mason 1988 and Collins 1991, among others).

However, these studies do not take into account the capital demand side and only under perfect capital mobility is this justified. Otherwise domestic savings and investment are jointly determined and cannot be analysed separately. Higgins (1998) is one of the authors that clearly state the necessity of taking into account the capital mobility when analyzing demographic effects because incomplete capital mobility can hamper demographically induced capital flows. As many studies have shown, capital is mostly not mobile (e.g., see French and Poterba 1991, Frankel 1992, Obstfeld 1995, Kang and Stulz 1997 and Portes and Rey 1999).

The most recent studies in the field rely on the **Overlapping Generations** (OLG) model, that derives follows directly from the life cycle hypothesis, which is its essence. Auerbach and Kotlikoff (1987) developed the first computable general equilibrium model of dynamic life-cycle economies. The simplest OLG model captures the fact that a population includes people with different ages and different planning horizons and that these individuals at different stages of their lifecycles interact in

markets. It enables us therefore to aggregate the behaviours of individuals at different stages of their lifecycle (described previously according to the lifecycle hypothesis) within a closed or open entity and to analyse the effects of interactions between groups of individuals.

Higgins and Williamson (1996) were able to show that investment is clearly linked to the labour force growth that needs to be equipped with capital. They also showed that savings rates are high for a large work force and decline gradually as the economy grows older. The authors concluded that we can expect a current account deficit in “young” economies because of their investment demand and their low level of national savings. The deficit then turns into a surplus as the economy becomes more aged.⁷ Higgins (1998) found empirical evidence for savings, investment and net capital flows’ patterns predicted in their simulation model. However, it can be problematic to interpret some of these results. Namely current account includes transactions in goods, services, and interest payments, between countries. The most suitable way to analyse investment behaviour would be focusing on transactions reflected by capital account.

Moreover, the present demographic patterns are not the only factor affecting current capital flows. Lührmann (2006) argues that expectations of the future demography should be taken into account in explaining present capital flows. She finds that if forward-looking agents expect demographic pressures to put in danger their retirement income due to reduced capital returns or unsustainable public pension system in future, people might decide to supplement their mandatory pension savings by increased private savings in order to provide themselves with a certain level of retirement income. The result of such anticipative behaviour could be high net capital outflows from industrialized countries to emerging markets in the present, if domestic investments remain roughly constant. The allocation of capital across countries might depend on the degree of imperfection of the destination country’s domestic capital market. Probably the best examples of capital flows that cannot be redirected each period are FDIs. However Lührmann was not the first author to discuss the role of expectations in explaining capital flows⁸.

⁷ The country becomes a net capital exporter when it has a larger working population.

⁸ Poterba (1998 and 2004) discusses anticipation effects and notes that forward-looking behavior by agents implies that savings and investment decisions are taken on the basis of present discounted values of the future earnings of investment

Brooks (2003) developed an OLG model with rational, forward-looking agents and found evidence that age distribution has significant effects on financial markets and that although agents are forward-looking, the transition from Baby-Boom to Baby-Burst will lead to a sharp decline in asset returns.

More recently, Börsch-Supan, Ludwig and Winter (2006) used a stylised multi-country overlapping generations model and long-term demographic projections for different sets of countries to project international capital flows over a seventy-year period and they found evidence that population ageing results, at least in an initial stage, in a higher capital stock, but when the Baby Boom generations start to consume their retirement savings the capital stock is expected to decrease. Their simulations suggest that significant effects of capital mobility will occur, even if capital flows are restricted to the OECD (capital flows from fast ageing countries to less fast ageing countries). They also conclude that saving rates, rates of return and international capital flows react substantially less to demographic change once households absorb some part of the demographic shock by lengthening the working period in their lives.

According to these models, individuals who save during their working lives to finance their consumption during retirement generate the capital stock in a country. Therefore a high population share of people in their thirties and forties is likely to generate a strong tendency towards capital outflows, while countries with higher youth dependency rates tend to be net importers.

All the authors mentioned so far focus mainly on the changes in the direction and volume of the international capital flows induced by demographic factors on an aggregate level. They do not pay an explicit attention to the impact of demographic factors in the different types of capital flows. As noticed by Lane and Milesi-Ferretti (2000), among others, different types of capital flows have different properties and according to the Modigliani-Miller Theorem only under perfect information and with no distortions, can we consider the capital structure as irrelevant.

goods and the value of savings. Brooks (2000) also focuses on the anticipation effects making the question “What will happen to financial markets when the Baby Boomers retire?”

The aggregation can therefore lead to wrong conclusions. In the following sections we try to compensate for this lack in the literature. We analyse the impact of ageing on foreign direct investments (FDI) and foreign portfolio investments (FPI) on a bilateral level.

The reasons for foreign portfolio investment flows were discussed above. To the best of our knowledge no literature has been issued concerning the direct relationships between ageing and FDIs. However there are certainly some linkages to be considered, which we can identify using traditional theories for explaining FDI flows. First of all the reason for investing into foreign countries could be the total output and market size of the destination country. The market seeking investors would go to the markets where there is a lower percentage of retired people. Moreover, if the destination country faces a higher youth dependency rate, the workers are expected to have lower savings rates and higher consumption rates. This could result in an investment gap and consumption deficit, which both encourage foreign investments into this country.

The additional reason to move from “aged” economies to “young” economies can be derived from the life cycle theory (Vernon 1966). First of all when the overall population size does not change and there are more retired people in an economy, who normally in average consume less, then the maturity stage of product life cycle will come earlier. Therefore the producers who want to compensate for R&D and product introduction costs will search for a lower-cost production destination and/or the markets with higher consumption. Especially it will be true for durable goods production.

Finally, if there is an oligopolistic competition then the oligopolistic reaction theory of Knickerbocker (1973) would predict even higher flows to the “younger” economies. Mainly because of two reasons: following the leader or “threatening” other firms on their home or main markets.

So we can expect the increase of FDI to “younger” economies from the side of market-seeking or/and efficiency-seeking foreign investors.

In what follows we develop an empirical specification in order to establish the link between demographic patterns and FDI and FPI flows.

4. Empirical Strategy

In this section we develop an empirical specification in order to study the impact of ageing on foreign direct investments (FDI) and foreign portfolio investments (FPI) on a bilateral level. The bilateral FDI and FPI are modelled by using fixed effects balanced panel data.

We analyse a panel dataset with 8 capital source countries⁹ and 38 capital host countries¹⁰ (see appendix 1 for the list of countries) for the years 2001 to 2007. As dependent variables we use FDI end-of-the-year positions by partner country and FPI end-of-the-year positions by partner country (as discussed in more detail in section 5). Unfortunately there were no longer time series data available for bilateral FDI and bilateral FPI.

The regression specification of the fixed effects model is:

$$y_{ijt} = \beta_0 + \delta_2 d2_t + \delta_3 d3_t + \dots + \delta_T dT_t + \beta_1 x_{ijt1} + \beta_2 x_{ijt2} + a_{ij} + u_{ijt},$$

for $t=1,2,3,\dots,T$

Where y_{ijt} are investments positions of a origin country i in a destination country j on time t . $d2_t$, $d3_t$ and dT_t are time period dummies. a_{ij} represents fixed effects (captures all unobserved, time-constant factors that affect y_{ijt}). x_{ijt1} are control variables capturing features of the economy of the two countries, x_{ijt2} are the variables for the demographical factors for the origin country and the destination country. u_{ijt} is the error term.

⁹ OECD countries (relatively more aged countries).

¹⁰ OECD and non-OECD countries (relatively less aged countries).

5. Data and variables

As dependent variables we use FDI end-of-the-year positions by partner country and FPI end-of-the-year positions by partner country. FDI data comes from OECD (International Direct Investment Statistics) and are presented in millions of US dollars. FPI data comes from the Coordinated Portfolio Investment Survey Data (CPIS), which is released by the International Monetary Fund, and accounts for Total Portfolio Investments (equities, short-term and long-term debt securities).

In order to capture features of the economy of the origin and destination country that can induce capital flows we use the following control variables (data sources in parenthesis)¹¹:

(1) GDPOC and GDPDC (World Development Indicators - WDI) – gross domestic product in the capital origin country and capital destination country, respectively. These variables are used to measure the level of development of the economy that determines the level of savings that the economy can generate. In addition, these variables determine the level of human capital, the level of economic development and the development of financial markets (Market Potential). We expect both variables to have a positive effect on international capital flows.

(2) MARKCAPDC (WDI) - market capitalization level of the capital destination country as a proxy for the market share of private business in a country. In addition this indicator presents the proxy for the level of development of the financial market. A positive sign is expected since the more developed the financial market of a country is, the more capital inflows are expected to occur.

(3) GKFDC (WDI) – gross capital formation on destination country. A negative sign is expected. As the gross capital formation in the destination country increases foreign capital inflows are expected to diminish (assuming that the investment gap diminishes with the increase in Gross capital formation)

(4) FREEDC (Freedom House) - a variable to capture national political stability on the destination country -political rights and civil liberties as a proxy of political stability. The justification for the use

¹¹ Complete list of data sources is provided in appendix 2.

of such variables is that political instability is connected with economic and financial instability and in that sense might influence the investor's decision. It is expected that the higher the political stability of a country, the higher the capital inflows to the destination country. A negative sign is expected¹².

(5) EFREEDC (Heritage Foundation) - a variable to capture economic freedom and prosperity in the destination country. If a government exerts coercion above a certain level in the market place, economic growth might suffer and that is expected to diminish the capital inflows to the host country. A positive sign is expected¹³.

Demographic factors are then measured by the following demographical variables¹⁴:

(1) DEPODC¹⁵ (WDI) - current old age dependency ratio of the destination country. Assuming that old-age is associated with pure dissaving, an increase in the share of the elderly should induce negative capital flows from the capital origin country to the capital destination country ("old" economies tend towards running current account deficits). Therefore a negative sign is expected for the coefficient of this variable.

(2) DEPYDC¹⁶ (WDI) - current youth age dependency ratio of the destination country. Higgins and Williamson (1996) found that we can expect a current account deficit in "young" economies because of their investment demand and their low level of national savings. Therefore countries with relatively

¹² Political Rights and Civil Liberties are measured on a 1-7 scale, with 1 representing the highest degree of Freedom and 7 the lowest. The Grading Scale used is: "F," "PF," and "NF" respectively stand for "free," "partly free," and "not free". Until 2003, countries whose combined average ratings for Political Rights and for Civil Liberties fell between 1.0 and 2.5 were designated "Free"; between 3.0 and 5.5 "Partly Free," and between 5.5 and 7.0 "Not Free." Beginning with the ratings for 2003, countries whose combined average ratings fall between 3.0 and 5.0 are "Partly Free," and those between 5.5 and 7.0 are "Not Free."

¹³ To measure economic freedom and rate each country, the authors of the Index measure ten components of economic freedom, assigning a grade to each using a scale from 0 to 100, where 100 represents the maximum freedom. The ten component scores are then averaged to give an overall economic freedom score for each country. The ten components of economic freedom are: Business Freedom, Trade Freedom, Fiscal Freedom, Government Spending, Monetary Freedom, Investment Freedom, Financial Freedom, Property rights, Freedom from Corruption, Labor Freedom.

¹⁴ All ratios are presented as number of dependants per 100 people in working age (15-65).

¹⁵ Old age dependency ratio is defined as ratio of the population 65+ to the working-age population between ages 15 and 65.

¹⁶ Youth age dependency ratio is defined as ratio of the population between 0-14 to the working-age population between ages 15 and 65.

high youth dependency rates have a propensity to be capital importers. We expect a positive sign for the coefficient of this variable.

(3) DEPOF20OC (Projections of the United Nations) - old dependency ratio forecast in 20 years time of the origin country. If forward-looking agents expect demographic pressures (an increase in the share of the elderly) to put in danger their retirement income¹⁷, they might decide to supplement their mandatory pension savings by increased private savings today in order to provide themselves with a certain level of retirement income. The result of such anticipative behaviour could be an increase in capital flows from relatively more aged countries to relatively less aged countries in the present¹⁸. A positive sign is therefore expected.

(4) DEPYF20DC (Projections of the United Nations) - youth dependency ratio forecast in 20 years time for the destination country. If there are expectations that the destination country will have a higher youth dependency rate in the future, then lower saving rates and higher consumption rates in the upcoming future are expected. That can result in an investment gap and consumption deficit. Moreover it will have a positive impact in the future market size. This might encourage foreign investments into that country already in the present. This is especially feasible for FDIs since they are usually long term investments and cannot be redirected each period. The expected sign for the coefficient of this variable is therefore positive.

6. Empirical results

This section presents the results of the empirical specification developed in section 4. We report results for FDI and FPI end-of-the-year positions of a origin country i in a destination country j . As follows we discuss the results for the two dependent variables. The panel data analysis gives us results, which are in accordance with our expectations. As table 1 shows, the general performance of the model is satisfactory for both regressions.

¹⁷ Due to reduced capital returns or unsustainable public pension system in future.

¹⁸ Assuming that domestic investments remain roughly constant.

Table 1: Balanced Panel Data (Fixed Effects)

<i>Explanatory Variables</i>	<i>FDI_{ij}</i> <i>Foreign Direct Investment of a</i> <i>origin country i in a destination</i> <i>country j</i>	<i>FPI_{ij}</i> <i>Foreign Portfolio Investment of a</i> <i>origin country i in a destination</i> <i>country j</i>
Constant	-142,610*** (38,475)	-332,139*** (86,195)
GDPOC	0.00487*** (0.00188)	0.0255*** (0.00535)
GDPDC	0.0274*** (0.00757)	0.0683*** (0.0212)
MARKAPDC	-3.12e-10 (1.02e-09)	5.48e-09 (4.76e-09)
GKFDC	-4.38e-08** (1.73e-08)	-1.15e-07** (5.03e-08)
FREEDC	332.5 (472.5)	904.9 (1,551)
EFREEDC	85.70 (78.77)	435.4 (272.8)
<i>Explanatory Demographic Variables</i>		
DEPOOC	-2,257*** (810.8)	-5,318*** (2,050)
DEPYDC	1,618*** (489.2)	8,564*** (1,741)
DEPYF20DC	1,941** (835.4)	-1,621 (2,352)
DEPOF20OC	2,132*** (702.0)	3,507* (1,899)
Observations	2072	2072
No. of source countries	8	8
No. of host countries	38	38
Prob > F	0.0000	0.0000
R-squared	0.329	0.459

Notes: Robust standard errors in parentheses. *, **, *** indicate statistical significance at the 10%, 5% and 1% confidence level.

The explanatory power of the regression with FPI as dependent variable is to some extent bigger than the one with FDI dependent variable ($R^2=0.459$ and $R^2=0.329$ respectively).

Regarding the control variables, used in order to capture features of the economy of the origin and

destination countries that can induce capital flows, three are statistically significant in both regressions (GDPOC, GDPDC, GKFDC).

GDPOC and GDPDC, used as measurements of economic size, present a positive sign for both regressions and this goes according to our expectations. In recent years several studies applied the methods from traditional gravity models to bilateral international investments¹⁹ and found that the market size of source and destination countries have a positive effect on cross-border capital flows.²⁰

Gross capital formation on destination country (GKFDC) exerts a very small, but statistically significant, negative influence on both dependent variables. That goes according to our expectations for the reasons offered in section 5.

The other three variables used as control variables (MARKAPDC, FREEDC and EFREEDC) are not statistically significant for both regressions with FDI_{ij} and FPI_{ij} as dependent variables.

To study the impact of the current age structure of a country on bilateral international capital flows we use two variables, namely the DEPOOC and DEPYDC. Both variables are highly significant at a 1% level for both regressions. This confirms that the present age structure influences cross-border capital flows

The DEPOOC variable is the old dependency ratio in the capital origin country. The coefficient presents a negative sign for both FDI and FPI regressions confirming our prediction that an increase in the share of the elderly (associated with dissaving) is linked with a tendency towards capital inflows to the source country (repatriation of capital). The most obvious difference between the two regressions lies on the magnitude: the coefficient of the variable DEPOOC is more than the double for FPI than it is for FDI.

¹⁹ Studies on FDI include Wei (2000) and Stein and Daude (2007) and studies on portfolio equity flows include the one of Portes and Rey (2005).

²⁰ Also the distance between countries (among others) influence capital flows but since we use a fixed effects specification in our analysis time-invariant variables are included in α_{ij} as explained in section 3.

The variable DEPYDC, which accounts for the youth dependency ratio for the destination country, has a positive effect both on FPI and FDI, as we predicted. That can be explained because “young” economies have a high investment demand while generating few savings domestically, and that tends to draw the economy into a current account deficit. That implies an increase in the capital flows from the source to the host country. We want to stress that the differences in magnitude of the demographic effect on explaining FDI and FPI flows are again considerable. In this case the magnitude is five times higher for the FPI regression than it is for the FDI regression. That comes as no surprise as it confirms our hypothesis that demographic factors have different impacts on FPI and FDI since different types of capital flows have different properties²¹.

The observed differences in magnitude can probably be explained with the fact that FPI usually have more liquidity and tradability than FDI. Moreover the former is usually more driven by present factors than the latter, which is usually a somewhat longer term investment and cannot be redirected each period.

To test the possibility that international capital flows can be related to the expectations about the future demographic trends we use two additional demographic variables, namely the DEPOF20OC and DEPYF20DC. At this juncture, the distinctions between the two regressions are even more significant.

The variable DEPOF20OC presents a positive sign confirming our expectations. It is significant at the 5% level for the regression with FDI as dependent variable and significant at the 10% for the second regression, with FPI as dependent variable. The magnitudes are also different for both regressions (to some extent bigger for the FPI than for FDI). If forward-looking agents in the origin country expect an increase in the share in the elderly in 20 years time they are likely to increase private savings today and that can lead to an increase in the current capital flows from relatively more aged countries to relatively less aged countries²².

²¹ As noticed by Lane and Milesi-Ferretti (2000), among others.

²² As noticed before, differences in demographics are likely to reinforce the differentials in the expected rates of return to capital between industrial (relatively more aged countries) and developing countries (relatively less aged countries), making the investment in developing countries more attractive relatively to the investment in developed countries.

The variable DEPYF20DC is only statistically significant for the regression with FDI as dependent variable (at a 5% level) presenting the expected positive sign. For the regression with FPI as dependent variable it is not statistically relevant and the sign is not according to our expectations. Once more the divergence in the results can be explained by the different properties of the capital flows. As aforesaid FDI are usually long term capital flows while FPI are usually short and medium term capital flows. Moreover FPI²³ are relatively less forward looking than FDI.

These results confirm our hypothesis that future age structure of the nation has significant effect on current international capital flows and reinforce the confirmation of our suspicion that demographic factors have different impacts on FPI and FDI and therefore deserve a separate study.

7. Conclusion

This paper develops an empirical framework in order to study the impact of ageing on international capital flows. The Life Cycle Theory, Overlapping Generation's (OLG) model, and some recent empirical works suggest that ageing of populations can lead to an increase in savings of working population. At the same time increase in the share of elderly people and youth can decrease the savings of the economy and the capital demand because of lower level of labor force. As a result differences in demographics are likely to reinforce the differentials in the expected rates of return to capital between industrial (faster ageing) countries and developing (slowly ageing) countries in the future. But the current age structure of a nation should not be the only factor to be taken into account. The expectations about the future age structure of the nation can force forward-looking agents to change their investment behavior in favor of relatively younger countries. This might lead to higher capital export from developed countries to emerging economies already today.

To test these relationships we use fixed effects balanced panel data with bilateral FDI and FPI positions as dependent variables.

²³ Portfolio Investments are usually connected with the expression "hot money" in the financial press.

The results, presented in section 6, suggest that the current and future age structure of the nations has significant effect on current international capital flows. Moreover, we found evidence that demographic factors have different impacts on FPI and FDI.

There are several directions for future research. One important issue is the role of the precedent bilateral FDI and FPI flows to explain present bilateral capital flows. If we find that the existence of previous cross-border capital flows influence present and future capital flows a dynamic panel data model, with lagged dependent variables, might be preferable to the fixed effects balanced panel data used in our study.

A problem that might arise with the use of lagged dependent variables is the significant correlation of the lagged dependent variable with the error term in the scenario of a short time dimension and a larger country dimension (the state of this paper analysis). However even if no longer-time-series data become available in the future, for bilateral FDI and bilateral FPI, using the Arellano – Bond Dynamic Panel GMM Estimators might solve the correlation issues.

Another interesting topic would be to learn if the recent financial crisis increases the differentials in the expected rates of return of capital between faster ageing countries and slowly ageing countries. We defer that for future research.

References

- Ando, A. and F. Modigliani (1963):** “The Life-Cycle Hypothesis of Saving: Aggregate Implications and Tests”. *American Economic Review* 53: pp. 55-84.
- Auerbach, A.J. and L.J. Kotlikoff (1987):** *Dynamic Fiscal Policy*. Cambridge: Cambridge University Press.
- Bashki, G. S. and Z. Chen (1994):** “Baby Boom, Population Aging, and capital Markets”. *The Journal of Business* 67(2): pp. 165-202. Univ. of Chicago Press.
- Bloom, D.E., D. Canning, and J. Sevilla (2001):** “Economic Growth and the Demographic Transition”. NBER Working Paper 8685.
- Bloom, D.E., D. Canning, R. Mansfield, and M. Moore (2006):** “Demographic Change, Social Security Systems, and Savings”. NBER Working Paper 12621.
- Bommier A. and R. D. Lee (2000):** “Overlapping Generations Models with Realistic Demography”. *University of California at Berkeley, Working Paper 002*.
- Börsch-Supan, A., A. Ludwig, and J. Winter (2002):** “Ageing and International Capital Flows”. Working Paper 02-27. MEA, University of Mannheim.
- Börsch-Supan, A., A. Ludwig, and J. Winter (2005):** “Aging, Pension Reform, and Capital Flows: A Multi-Country Simulation Model”. NBER Working Paper 11850.
- Börsch-Supan, A., A. Ludwig, and M. Sommer (2007):** “Aging and Asset Prices”. *MEA Discussion Paper*, 129: pp. 1-75.
- Brooks, R. (2000):** “What Will Happen to Financial Markets When Baby Boomers Retire?”. Discussion paper WP/00/18. International Monetary Fund.
- Bryant, R.C. (2004):** “Cross-Border Macroeconomic Implications of Demographic Change”. Brookings Discussion Papers in International Economics, No.166.
- Carmichael, B. and A. Coen (2003):** “International Portfolio Choice in an Overlapping Generations Model with Transaction Costs”. *Economics Letters* 80: pp. 269-275.
- Carstensen, K. and F. Toubal (2003):** “Foreign direct investment in Central and Eastern European countries : a dynamic panel analysis”, Kiel Working Paper, Institute for World Economics.
- Charles Yuji Horioka, C.Y., W. Suzuki, and T. Hatta (2007):** “Aging, Saving, and Public Pensions in Japan”. NBER Working Paper 13273
- Chun, Y.J. (2006):** “Population Aging, Fiscal Policies, and National Saving: Prediction for Korean Economy”. NBER Working Paper 12265.
- Coale, A. J. and E. M. Hoover (1958):** *Population Growth and Economic development in Low-Income Countries*. Princeton: Princeton University Press.
- Cole, H. L. and W. B. English (1991):** “Expropriation and Direct Investment”. *Journal of International Economics*, 30(May): pp. 201-27.
- Cole, H. L. and W. B. English (1992):** “Two-Sided Expropriation and Equity Contracts”. *Journal of International Economics*, 33(May): pp. 77-104.

- Collins, S. M. (1991):** "Saving Behavior in Ten Developing Countries". In D.B. Bernheim and J.B. Shoven (Eds), *National Saving and Economic Performance*, A National Bureau of Economic Research Project Report: pp. 349-375. Chicago: University of Chicago Press.
- D'Albis, H. (2007):** "Demographic Structure and Capital Accumulation". *Journal of Economic Theory*, 132: pp. 411-434.
- Faruquee, H. (2002):** "Population Aging and Its Macroeconomic Implications: A Framework for Analysis". International Monetary Fund WP/02/16.
- Fehr, H, S. Jokisch, and L. Kotlikoff (2004):** "The Role of Immigration in Dealing With the Developed World's Demographic Transition". NBER Working Paper 10512.
- Feldstein, M. (1994):** "Tax Policy and International Capital Flows". NBER Working Paper 4851.
- Feldstein, M. (1999):** "International Capital Flows". NBER Conference Report.
- Feldstein, M. (2001):** "The Future of Social Security Pensions in Europe". NBER Working Paper 8487.
- Feldstein, M. and C. Horioka (1980):** "Domestic saving and international capital Flows". *Economic Journal* 90: pp.314-329.
- Flötotto, M. (2006):** *Housing and Portfolio Choice: A Life Cycle Simulation Model*. Diploma Thesis, Mannheim: MEA.
- Frankel, J. A. (1992):** "Measuring International Capital Mobility: A Review". *American Economic Association – Papers and Proceedings* 82(2): pp. 197-202.
- French, K. R. and J. M. Poterba (1991):** "Investor diversification and International Markets". *American Economic Association – Papers and Proceedings* 81(2): pp. 222-226.
- Goyal, A. (2002):** "Demographics, Stock Markets Flows, and Stocks Returns". Anderson Graduate School Of Management, UCLA, Research Paper.
- Higgins, M. and J. G. Williamson (1996):** "Asian Demography and Foreign Capital Dependence". NBER Working Paper 5560.
- Higgins, M. and J. G. Williamson (1997):** "Age Structure Dynamics in Asia and Dependence on Foreign Capital". *Population and Development Review, New York Population Council*, 23(2): pp. 261-293.
- Higgins, M. D. (1994):** *The Demographic Determinants of Savings, Investment and International Capital Flows*. PhD Dissertation Thesis, Harvard University. Cambridge, MA.
- Higgins, M. D. (1998):** "Demography, National Savings, and International Capital Flows". *International Economic Review*, 39(2): pp. 343-369.
- Hock, H. and D. N. Weil (2006):** "The Dynamics of the Age Structure, Dependency, and Consumption". NBER Working Paper 12140.
- Holzmann, R. (2000):** "Can Investments in Emerging Markets help to solve the Aging Problem". CESifo Working Paper 304, Munich.
- Hull, L. and L. Tesar (2000):** "Risk, Specialisation and The Composition of International Capital Flows". University of Michigan, Working Paper.

- Hull, L. and L. Tesar (2000):** "The Structure of International Capital Flows". University of Michigan, Working Paper.
- Irmen, A. (2009):** "Population Aging and the Direction of Technical Change". Working Papers 0493, University of Heidelberg, Department of Economics.
- Jagannathan, R. and N.R. Kocherlakata (1996):** "Why should older people invest less in stock than younger people?". Federal Reserve Bank of Minneapolis, *Quarterly Review*, 1996(2): pp.11-23.
- Kang, J.-K. and R. Stulz (1997):** "Why Is There a Home Bias? An Analysis of Foreign Portfolio Equity Ownership in Japan". *Journal of Financial Economics*, 46: pp. 3-28.
- Knickerbocker, F.T. (1973):** *Oligopolistic Reaction and Multinational Enterprise*. Boston: Harvard University Press.
- Krueger, D. and A. Ludwig (2007):** "On the Consequences of Demographic Change for Rates of Returns to Capital, and the Distribution of Wealth and Welfare". *Journal of Monetary Economics*, vol. 54(1): pp. 49-87.
- Lane, P.R. and G.M. Milesi-Ferretti (2008):** "International Investment Patterns". *Review of Economics and Statistics*, 90(3):: pp. 538-549.
- Lane, P.R. and G. M. Milesi-Ferretti (2000):** "External Capital Structure: Theory and Evidence". CEPR Discussion Paper 2583.
- Ludwig, A., D. Krueger, and A.H. Börsch-Supan (2007):** "Demographic Change, Relative Factor Prices, International Capital Flows, and Their Differential Effects on the Welfare of Generations". NBER Working Paper 13185.
- Lührmann, M. (2006):** *Essays on the Impact of Demographic Change on Capital, Goods and Labor Markets*. PhD Dissertation, Inauguraldissertation zur Erlangung des akademischen Grades eines Doktors der Wirtschaftswissenschaften der Universität Mannheim, University of Mannheim.
- MacKellar, L. and H. Reisen (1998):** "A Simulation Model of Global Pension Investment": OECD Development Centre Technical Papers 137, Paris.
- Mason, A. (1988):** "Saving, Economic Growth and Demographic Change". *Population and Development Review* 14(1): pp. 113-144.
- Modigliani, F. (1988):** "The Role of Intergenerational Transfers and Life Cycle Saving in the Accumulation of Wealth". *The Journal of Economic Perspectives*, Vol. 2, No. 2: pp. 15-40.
- Modigliani, F. and R. Brumberg (1954):** "Utility Analysis and the Consumption Function: An Interpretation of Cross-Section Data". In K.K. Kurihara (Ed.), *Post-Keynesian Economics*. Rutgers University Press, New Brunswick, pp. 388-436.
- Obstfeld, M. (1995),** "International Capital Mobility in the 1990s". In P.B. Kenen (Ed.), *Understanding Interdependence – The Macroeconomics of the Open Economy*. Princeton: Princeton University Press, pp. 201-261.
- Portes, R. and H. Rey (2005):** "The Determinants of Cross-Border Equity Flows". *Journal of International Economics*, vol. 65(2): pp. 269-296.
- Poterba, J. M. (1998):** "Population Age Structure and Asset Returns: An Empirical Investigation". NBER Working Paper 6774.

- Poterba, J. M. (2004):** “The Impact of Population Aging on Financial Markets”. NBER Working Paper 10851.
- Poterba, J. M., J. Rauh, S. Venti, and D. Wise (2006):** “Lifecycle Asset Allocation strategies and the Distribution of 401(K) Retirement Wealth”. NBER Working Paper 11974.
- Razin, A. and E. Sadka (2001):** *Labor, Capital and Finance: International Flows*. Cambridge: Cambridge University Press.
- Reisen, H. (2000):** “Pensions, Savings and Capital Flows -The Economics of Global Pension Flows”, OECD.
- Sachs, J. D. and A. Warner (1995):** “Economic Reform and the Process of Global Integration”. *Brookings Papers on Economic Activity* 1995(1): pp. 1-96.
- Sadka E. (2001):** “Demographic Shocks and Global Factor Flows: Discussion” Presented at the Federal Reserve Bank of Boston conference on “Seismic Shifts: The Economic Impact of Demographic Change”.
- Shoven, J.B. and G.S. Goda (2008):** “Adjusting Government Policies for Age Inflation”. NBER Working Paper 14231.
- Stein, E.H. and C. Daude (2007):** “Longitude Matters: Time Zones and the Location of FDI,” *Journal of International Economics* 71(1): pp. 96–112.
- Taylor, A. M. (1998):** “Argentina and the World Capital Market: Saving, Investment, and International Capital Mobility in 20th Century”. *Journal of Development Economics* 57: pp. 147-184.
- Taylor, A. M. and J. G. Williamson (1994):** “Capital Flows to the New World as an Intergenerational transfer”. *Journal of Political Economics* 102(2): pp. 384-371.
- Taylor, A.M. (1994):** “Domestic Savings and International Capital Flows Reconsidered”. NBER Working Paper 4892.
- Vernon, R. (1966):** “International Investment and International Trade in the Product Cycle”. *Quarterly Journal of Economics* 80: pp. 190-207.
- Wei, S.-J. (2000):** “How Taxing Is Corruption on International Investors?” *Review of Economics and Statistics*, Vol. 82 (1): pp. 1-11.
- Williamson, J. G. (2001):** “Demographic Shocks and Global Factor Flows”. Presented at the Federal Reserve Bank of Boston conference on “Seismic Shifts: The Economic Impact of Demographic Change”.
- World Bank (1997):** Private capital flows to developing countries: the road to financial integration, International Bank for Reconstruction and Development, Oxford Univ. Press.
- Yoo, P. S. (1994):** “The Baby Boom and International Capital Flows”. Federal Reserve Bank of St. Louis Working Paper 1994-031A.

Appendix 1: Old Age Dependency Ratio Projections

Country Name	2010	2030	2050
Algeria	7	13	27
Angola	5	6	8
Argentina	17	21	30
Australia	21	34	40
Austria	26	40	52
Belgium	26	41	46
Brazil	10	20	36
Cameroon	6	7	10
Canada	20	37	43
Chile	13	26	36
China	11	24	38
Czech Republic	22	33	48
Denmark	26	37	40
Egypt, Arab Rep.	7	12	20
Finland	26	43	44
France	26	41	47
Germany	31	48	59
Hungary	24	31	44
India	8	12	20
Indonesia	9	15	29
Iran, Islamic Rep.	7	13	31
Ireland	17	25	41
Italy	31	44	62
Japan	35	53	74
Korea, Rep.	15	18	28
Mexico	10	18	36
Morocco	8	15	26
Netherlands	23	40	44
New Zealand	19	33	39
Nigeria	6	6	9
Norway	23	33	40
Philippines	7	12	19
Poland	19	35	52
Portugal	27	39	59
Romania	21	28	49
Russian Federation	18	30	39
South Africa	7	12	15
Spain	25	36	59
Sweden	28	37	41
Switzerland	26	40	45
Thailand	11	23	32
Turkey	9	15	29
Ukraine	22	31	42
United Kingdom	25	34	38
United States	19	32	35
Venezuela, RB	9	16	25

Source: Data gathered from United Nations World Population Prospects:
The 2008 Revision Population Database.

Appendix 2: Youth Age Dependency Ratio Projections

Country Name	2010	2030	2050
Algeria	39	32	28
Angola	84	66	47
Argentina	39	32	28
Australia	28	28	28
Austria	22	23	25
Belgium	25	27	28
Brazil	38	25	23
Cameroon	73	54	41
Canada	23	26	26
Chile	32	29	27
China	28	25	25
Czech Republic	20	22	27
Denmark	28	27	27
Egypt, Arab Rep.	51	38	31
Finland	25	28	27
France	28	28	29
Germany	20	21	23
Hungary	21	22	25
India	48	33	27
Indonesia	40	29	27
Iran, Islamic Rep.	33	27	27
Ireland	31	26	28
Italy	22	20	25
Japan	21	19	22
Korea, Rep.	22	27	26
Mexico	43	29	26
Morocco	42	34	29
Netherlands	26	27	27
New Zealand	30	29	27
Nigeria	78	55	41
Norway	28	28	27
Philippines	54	40	32
Poland	21	20	22
Portugal	23	20	24
Romania	22	20	23
Russian Federation	21	23	27
South Africa	47	40	33
Spain	22	22	28
Sweden	25	28	28
Switzerland	22	25	27
Thailand	30	28	28
Turkey	39	29	27
Ukraine	20	24	27
United Kingdom	26	28	27
United States	30	29	28
Venezuela, RB	45	35	29

Source: Data gathered from United Nations World Population Prospects:
The 2008 Revision Population Database.

Appendix 3: List of Countries

Source Countries (8)		Host Countries (38)	
<i>America</i>	<i>Northern America</i> United States of America	<i>Africa</i>	South Africa
<i>Europe</i>	<i>Euro Zone</i> France Germany Italy Netherlands <i>EU non-Euro Zone</i> Denmark United Kingdom <i>Western Europe</i> Switzerland	<i>America</i>	<i>Central America</i> Mexico <i>Northern America</i> United States of America Canada <i>South America</i> Argentina Brazil Chile Venezuela
		<i>Asia</i>	<i>Eastern Asia</i> China Japan Republic of Korea <i>Southern Asia</i> India <i>South-Eastern Asia</i> Indonesia Philippines Thailand <i>Western Asia</i> Turkey
		<i>Europe</i>	<i>Euro Zone</i> France Germany Ireland Italy Netherlands Portugal Spain <i>EU Non-Euro Zone</i> Czech Republic Denmark Hungary Norway Poland Romania Sweden United Kingdom <i>Eastern Europe</i> Russian Federation Ukraine <i>Western Europe</i> Switzerland
		<i>Oceania</i>	Australia New Zealand

Notes: Countries listed according to the United Nations geoscheme.

Appendix 2: Data Sources

Variable Name	Label	Sources
Foreign Direct Investments	FDI	OECD International Direct Investment Statistics
Foreign Portfolio Investments	FPI	IMF Coordinated Portfolio Investment Survey Data (CPIS) – International Monetary Fund
GDP	GDPSC GDPHC	World Bank World Development Indicators
Market capitalization level	MARKAPHC	World Bank World Development Indicators
Gross capital Formation	GKFHC	World Bank World Development Indicators
Political rights and civil liberties	FREEHC	Freedom House http://www.freedomhouse.org/template.cfm?page=439
Economic freedom	EFREEHC	Heritage Foundation http://www.heritage.org/Index/
Current Demographic Data	DEPOSC DEPYHC	World Bank World Development Indicators
Demographic Projections	DEPOF20SC DEPYF20HC	UN Projections of the United nations (United Nations World Population Projects)